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Ushiro

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[54] **WEFT FEEDING MECHANISM OF A SHUTTLELESS WEAVING LOOM**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[3] **D03D 47/34**

[52] **U.S. Cl.** **139/452**; 139/453

[58] **Field of Search** 139/429, 452, 453

[56] **References Cited**

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Attorney, Agent, or Firm—Robert E. Burns; Emmanuel J. Lobato; Bruce L. Adams

[57] **ABSTRACT**

Weft feeding mechanism of a shuttleless loom comprises a feed roller driven from a loom shaft, a pressure roller engageable with the feed roller, another roller engageable with the feed roller in accordance with separation of the pressure roller from the feed roller and in gearing connection with the pressure roller, and control means for movement of the pressure roller into and out of engagement with the feed roller in response to a signal indicating insertion of a selected weft, whereby the pressure roller is constantly driven from the feed roller irrespectively of its position engaging with or separating from the feed roller.

8 Claims, 5 Drawing Figures

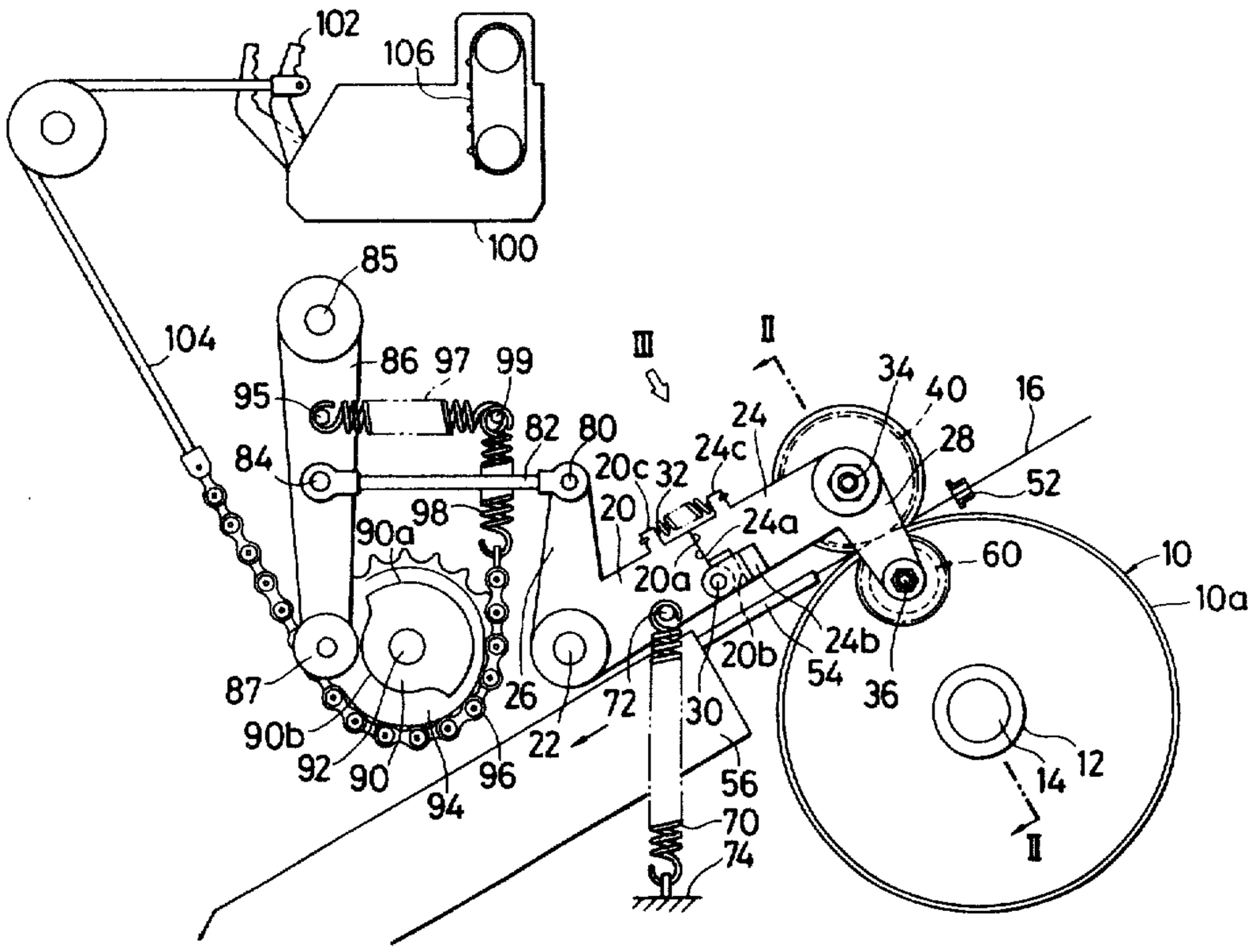

FIG. 1

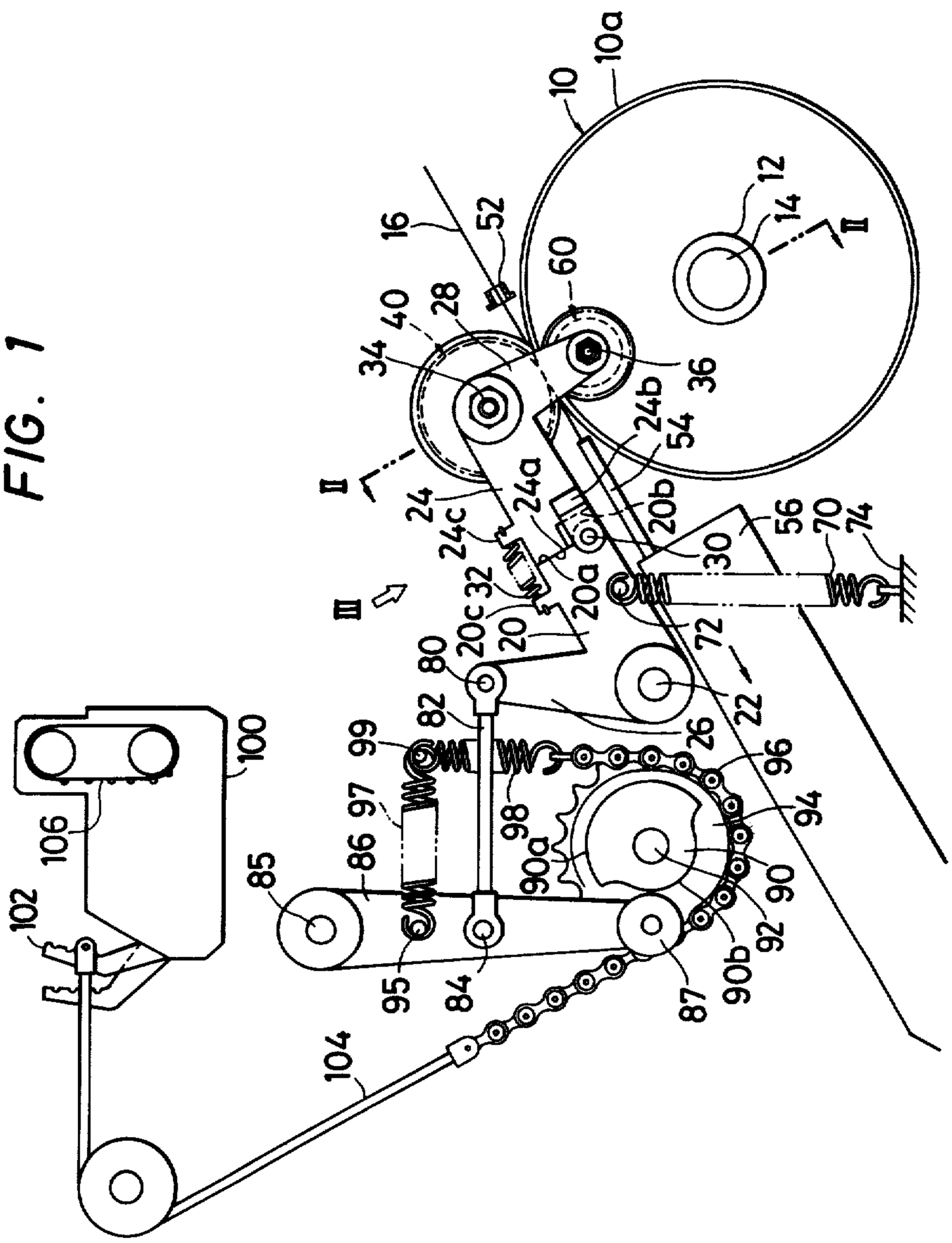
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FIG. 2

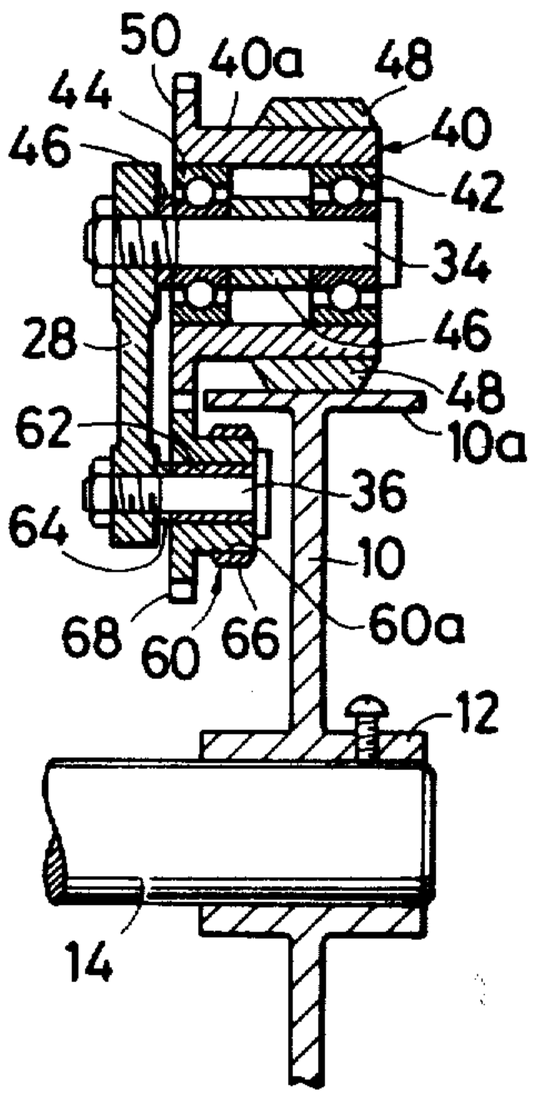


FIG. 5

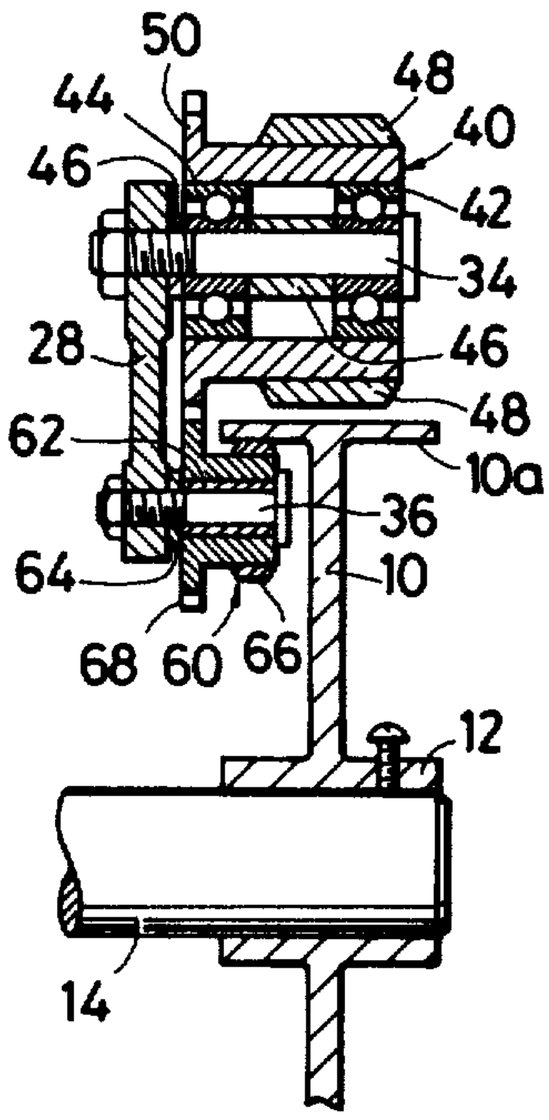


FIG. 3

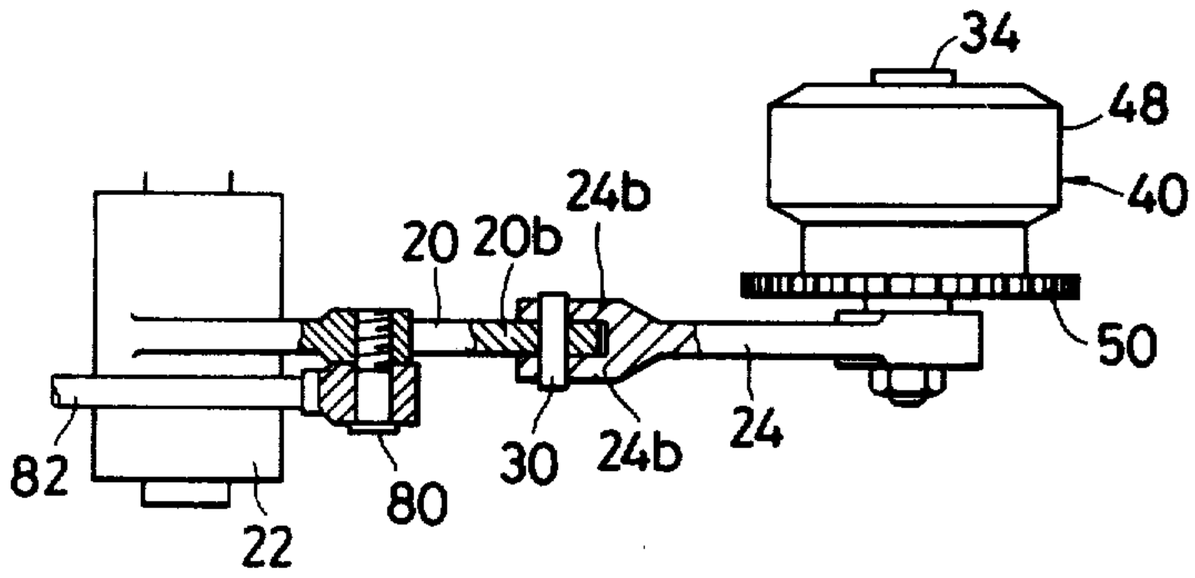
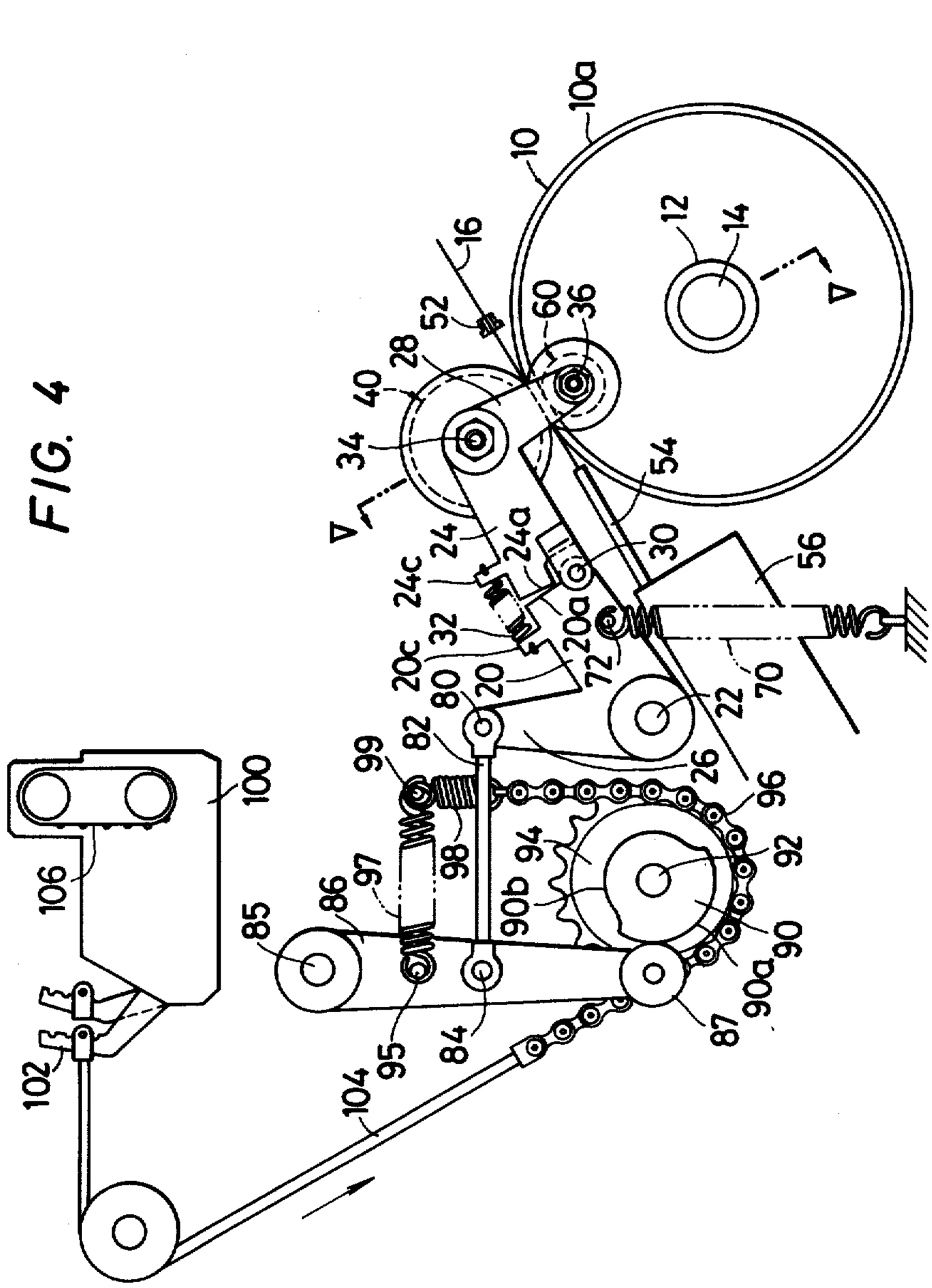


FIG. 4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WEFT FEEDING MECHANISM OF A SHUTTLELESS WEAVING LOOM

BACKGROUND OF THE INVENTION

This invention generally relates to shuttleless weaving looms and more particularly to a mechanism for selecting a weft to be inserted into a shed of warps among a plurality of weft yarns with which is obtained a variegated weft pattern and feeding the selected weft to the weft insertion device by a predetermined length.

In general, the weft feeding mechanism is provided by two frictionally engageable rollers for each of plural weft yarns, one of which, referred to as a feed roller, is driven from any convenient loom shaft. The other, pressure roller is selectively brought into and out of pressure engagement with the feed roller by an appropriate weft selector means in accordance with weft pattern signals carried on a weft pattern card arrangement. In response to a weft pattern signal representing insertion of any weft, the corresponding pressure roller is pressed against the feed roller to grip the weft together with the feed roller, thus driving the measured length of the weft to a weft storage means, which weft is then fed to the weft insertion device. In the absence of this signal, the pressure roller is separated from the feed roller; the weft is released and remains still on the feed roller.

In this type of feed mechanism, rotation of the pressure roller is slowed down or stops in its inoperative position where it is separated from the feed roller. When the pressure roller is again brought into contact with the feed roller, there will thus be a relatively great peripheral speed difference between the two rollers. It follows that the weft yarn rubs against the outer surfaces of both rollers rotating at different speeds, resulting in breakage of thread or fray of filaments in case of a filament yarn. This of course objectionably influences the quality of a cloth woven in the loom with this mechanism.

Several proposals are so far made to avoid or alleviate this inconvenience in the weft feeding mechanism. One example is disclosed in U.S. Pat. No. 3,885,599 filed Oct. 1, 1973 under Ser. No. 402, 276 by Thomas Blackburn Mawdsley et al, in which the two shafts respectively carrying the rollers also carry thereon two pinions concentrically with the rollers. At the position of maximum separation of the rollers, the pinions remain in mesh with each other. In this prior art, accordingly, both rollers can be driven continuously whether supplying weft yarn or not to the storage element.

According to another known example, two pressure rollers are provided on a common shaft, one of which engages with the feed roller while the other is separated from the same. The pressure roller separated from the feed roller is positively driven from the other pressure roller in engagement with the feed roller via a drive transfer means in the form of a pair of rollers engaging respectively the pressure rollers. Thus the pressure roller in the inoperative position can be constantly rotated generally at the same peripheral speed as the pressure roller directly driven by the feed roller.

However, these two examples and others were found impractical for some reasons. For instance, in the first-mentioned example, the pressure roller is driven by the feed roller not directly but by way of the pinions also in its operative position engaging the feed roller. Hence, it is difficult to maintain exactly the same peripheral speed

of the two rollers without highly precisely manufactured pinions and rollers. Wear of the rubber-coated outer surfaces of the rollers will accelerate the speed difference thus resulted between the two rollers. Also, an increased bulk and mounting space is taken, particularly in the latter example, for mounting the two pressure rollers and correspondingly two drive transfer rollers. Also the drive transfer member mounted above the pressure rollers will be a bar to handling the thread by the loom operator in the neighbourhood of the feed mechanism.

SUMMARY OF THE INVENTION

It is therefore a primary object of the invention to provide an improved weft selecting and feeding mechanism of the afore described character which feeds the selected weft yarn to the warp shed without the defects as mentioned above for preparing a cloth of excellent quality.

Another object of the invention is to provide a simple and compact drive transfer means for a weft feeding mechanism of the aforedescribed character, via which the drive of a feed roller is transmitted to a pressure roller in a position separated from the feed roller for rotation generally at the same peripheral speed as in its operative position engaging the feed roller.

Still another object of the invention is to provide an improved weft feeding mechanism of the aforedescribed character which comprises, besides pressure roller and feed roller, a third roller adapted to be brought into pressure engagement with the feed roller in cooperation with separation of the pressure roller from the feed roller and a gearing for drive-transmitting connection between the pressure roller and third roller.

A further object of the invention is to provide an improved selective control mechanism for a weft feed mechanism of the aforedescribed character which accurately controls motion of the pressure roller and another roller with respect to the feed roller in dependence on the corresponding weft pattern signal.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will be apparent as the following explanation of a preferred embodiment of the invention proceeds, with reference to the accompanying drawings, in which like reference numerals indicate like and similar parts throughout several figures and wherein:

FIG. **1** is a schematic plan view of a weft feed mechanism according to a single preferred embodiment of the invention with a pressure roller in the operative position;

FIG. **2** is a section taken along the line II—II of FIG. **1**;

FIG. **3** is an elevation viewed in the direction indicated by an arrow in FIG. **1**;

FIG. **4** is a view similar to FIG. **1** but showing the pressure roller in the inoperative position; and

FIG. **5** is a section taken along the line V—V of FIG. **4**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Represented by **10** is a weft feed roller of a relatively large diameter, which is at its boss **12** fastened or screwed to a rotary shaft **14** driven from any convenient

loom shaft (not shown) for rotation in synchronism with weaving cycle of loom.

An angled lever **20** is at its elbow rockably mounted on a fixed shaft **22** provided in parallel with the rotary shaft **14**. Another angled lever **24** which is located oppositely to the aforementioned lever **20** abuts at its one end **24***a* against the adjacent end **20***a* of the angled lever **20**. The two levers **20, 24** in rest position are thus generally in alignment with each other with their arms **26, 28** oppositely directed as illustrated in FIG. **1**. As best seen in FIG. **3**, the two levers **20, 24** are joined together in a manner that a projection **20***b* formed at the end **20***a* of the lever **20** is gripped by a fork **24***b* at the end **24***a* of the lever **24** and is transversely passed by a pivot pin **30** together with the fork **24***b*. Above this joint portion in FIG. **1**, the two levers **20, 24** are respectively formed with lugs **20***c*, **24***c* which are bridged by tension spring **32**. The spring **32** thus biases the lever **24** in counter-clockwise direction in FIG. **1** so that the two levers may swing bodily together in close contact with each other. On the other hand, the levers are able to limitedly pivotally displace relative to each other about the pivot pin **30** against the spring **32**, as will be later explained.

The carrier arm **28** depends generally at right angle from the lever **24** and extends in parallel with the roller **10** at a certain axial distance therefrom inwardly beyond the outer periphery of the roller **10**. Carried by the carrier arm **28** are two spindles **34, 36** fastened to the top and bottom ends thereof. Relative position of the feed roller **10** and the spindles is therefore such that a brim **10***a* of the feed roller is disposed intermediate between the spindles **34** and **36** as seen in FIG. **2**. The pressure roller **40** is mounted on the upper spindle **34** freely rotatably by means of two ball type bearings or the like **42, 44**. Represented by **46** are spacers for providing spaces respectively between the two bearings **42, 44** and between the bearing **44** and carrier arm **28**.

The outer surface **40***a* of the pressure roller **40** engageably faces the feed roller **10** and is wrapped by a rubber ring **48** providing an operating friction surface when engaged with the feed roller **10**. The axial end of the roller **40** outside of the feed roller **10** is integrally formed with a pinion or gear **50** for the purpose that will be apparent later. FIG. **1** illustrates that the pressure roller **40** is in pressure engagement with the feed roller **10** so that the weft yarn **16** delivered from a source of weft (not shown) through a guide **52** is gripped between and driven by the two rollers **10, 40** to reach a tubular guide **54** of a weft storage tube **56**.

Also the lower spindle **36** rotatably carries a roller **60**. Specifically, the roller **60** is mounted on a bushing **62** onto which the spindle **36** is pressed. An end of the spindle **36** is fastened to the carrier arm **28** by a nut via a spacer **64**. The outer surface **60***a* of the roller is encircled by a rubber ring **66** and is engageable opposite to the inner surface of the brim **10***a*. The axial end of the roller **60** outside of the feed roller **10** is also formed with pinion **68** which is in constant mesh with the pinion **50** on the pressure roller. Gear ratio of the pinions **50, 68** is so determined that the peripheral velocity of the pressure roller **40** in the inoperative position where the roller **60** engages the roller **10** is substantially equal to the peripheral velocity of the feed roller **10**.

The angled lever **20** is biased in clockwise direction in FIG. **1** about the fixed shaft **22** by means of a spring **70** which is borne at one end by a pin **72** planted on the lever **20** and at the other fixed to a stationary part **74** of the mechanism. The end of the lever **20** opposite to the end **20***a* is further formed with a fixed stud **80** on which a link rod **82** is pivotally mounted. The other end of the link rod **82** is also pivotally mounted on a pin **84** planted on the intermediate portion of a cam lever **86** that will be further mentioned.

Indicated by numeral **90** is a cam rotatably mounted on a fixed cam shaft **92**. The cam **90** has a raised surface **90***a* and a lowered surface **90***b* of the shape as illustrated. A sprocket wheel **94** is mounted on the cam shaft **92** concentrically and integrally with the cam **90** so that the cam **90** and the sprocket wheel **94** rotate together. Around the sprocket wheel is wrapped a chain **96**, one end of which is retained by a spring **98** hung on a fixed pin **99**. The other end of the chain **96** is connected, for instance, with a shedding lever **102** of a dobby mechanism **100** that will be explained later by means of a rope or cable **104**.

Engageable with the cam **90** is a circular cam follower **87** carried by the cam lever **86** which is rockably mounted on a fixed cam lever shaft **85**. The cam lever **86** is constantly biased in counter-clockwise direction in FIG. **1** by means of a spring **97** having one end hung on a pin **95** fastened to the cam lever and the other end hung on the pin **99** together with spring **98**.

Camming action of the cam **90** and follower **87** thus causes rocking movement of the cam lever **86**, which is transferred to the angled lever **20** via link rod **82** for swinging movement of the lever **20**. It would be readily seen that the swinging movement of the lever **20** together with the lever **24** results in limited reciprocal motion of the carrier arm **28**.

The dobby mechanism **100** is of the known type which is provided with a pattern card arrangement **106** carrying the desired weft pattern signals, in accordance with which shedding motion is controlled. As usual, multiple shedding levers are provided, one for each heald (not shown), to be able to form a number of warp sheds corresponding to variegated and complicated weft patterns. Usual weaving operation, however, seldom employs all of the shedding levers and some of the levers remain unused in most cases. In the illustrated embodiment, the extra shedding levers **102** which are not in use for shedding operation are exploited to control the operation of the weft feed mechanism. That is, the ropes **104** for driving the chain **96** and therefore the sprocket wheels **94** are connected with the extra shedding levers as previously described.

The feed mechanism constructed as above operates in a manner hereinafter described. As weft pattern signal selected by the pattern card arrangement indicates feeding of the weft **16** in FIGS. **1** and **4**, the shedding lever **102** swings in clockwise direction in the drawings thus withdrawing the rope **104**. The chain **96** is then pulled up against the spring **98**, whereupon the sprocket wheel **94** and therefore the cam **90** rotate in clockwise direction. The cam then at its lowered surface **90***b* engages the cam follower **87** as shown in FIG. **1**. The cam lever **86** is thus rotated about the shaft **85** in counter-clockwise direction. This angular movement of the cam lever **86** is transferred to the angled lever **20** by way of the link rod **82** and causes the angled lever **20** to swing in clockwise direction about the fixed shaft **22** with the aid of the spring **70**. The angled lever **24** is kept abutting at its end face against the corresponding end of the angled lever **20** by the action of the spring **32** so that both levers bodily swing in clockwise direction. It follows that the rubber ring **48** of the pressure roller **40** in the operative position is pressed against the feed roller **10**.

The weft yarn **16** gripped between the rubber ring **48** and the outer surface of the feed roller **10** is driven by a suitably measured length and is delivered to the storage tube **56** through the tubular guide **54**. When the stored weft yarn reaches a predetermined length, the weft yarn is inserted into the selected shed by means of the non-illustrated weft insertion device.

The roller **60** is in this instance away from the inner surface of the roller **10** and is driven from the pressure roller **40** through the pinions **50** and **68**.

Subsequent length of the same weft yarn **16** is measured and fed to the storage tube in a similar manner.

When another weft yarn is then selected, the shedding lever **102** is moved leftwardly as in FIG. **4**. Consequently, the rope and chain are allowed to be pulled in the arrow-indicated direction by the action of the spring, rotating the sprocket wheel **94** in counter-clockwise direction. The raised surface **90***a* of the cam **90** now engages the cam follower **87**. The cam lever **86** then rocks about the shaft **85** in clockwise direction; and angled lever **20** limitedly swings about the shaft **22** in counter-clockwise direction. The lever **24** also swings in the same direction together with the lever **20**, whereupon the roller **40** disengages from the outer surface of the roller **10** assuming the rest or inoperative position. The weft yarn **16** is relieved from the pressure of the roller **40**; measuring and feeding motion of the corresponding mechanism is thus terminated.

On the other hand, the roller **60** is now brought into engagement with the inner surface of the brim **10***a* with rising movement of the carrier arm **28** due to bodily swinging movement of the levers **20** and **24**. As soon as this engagement takes place, the lever **24** can no longer swing about the shaft **22** with the lever **20** and is angularly displaced relative to the lever **20** about the pivot pin **30** against the action of the spring **32**. The tension of the spring **32** keeps the roller **60** in resilient contact with the inner surface of the brim **10***a*. The pressure roller **40** apart from the feed roller **10** is thus driven by the roller **60** through pinions **68**, **50** generally at the same peripheral velocity as in its direct engagement with the roller **10**.

When the weft **16** is again selected after insertion of some other wefts in accordance with pattern signals, the pressure roller **40** is again brought into direct contact with the roller **10** in a manner previously explained. Since the pressure roller **40** in the inoperative position has continued to rotate as described above, it therefore can be smoothly synchronized with the roller **10**, thus stably driving the weft.

To more dependently eliminate a slip between the yarn and the pressure roller for the initial period of driving operation, it is preferable to so select the gear ratio of the pinions **50**, **68** that the peripheral velocity of the pressure roller **40** in the inoperative position where the roller **60** engages the roller **10** is somewhat larger than the peripheral velocity of the roller **40** in the operative position. The pressure roller **40** thus driven at an enhanced speed surely grips the weft and can drive it at the preset speed in the initial stage of driving operation.

What is claimed is:

1. In a shuttleless weaving loom

a weft inserting device;

a weft selector for selecting a weft yarn to be inserted into a warp shed, almongst a plurality of yarns in accordance with a predetermined weft pattern and producing a signal indicative of the selected weft yarn;

a plurality of weft drive devices, one for each of said weft yarns, for driving the weft yarns to said weft insertion devices, each of said weft drive devices including:

a feed roller constantly driven by a shaft which rotates in synchronism with the weaving cycle of said loom;

a pressure roller;

means having a lever on which said pressure roller is rotatably mounted and which is responsive to said signal for moving said lever toward said feed roller to bring said pressure roller into contact with the outer periphery of said feed roller; and

another roller carried on said lever which is in drive connection with said pressure roller and disposed opposite the inner periphery of said feed roller so as to be held out of contact with said inner periphery when said pressure roller is brought into contact with the outer periphery of said feed roller and brought into contact with said inner periphery when said pressure roller is held out of contact with said outer periphery of said feed roller.

2. A shuttleless weaving loom comprising:

a weft insertion means;

a weft selector means for selecting a weft to be inserted into a warp shed among a plurality of weft yarns in accordance with a desired weft pattern and producing a signal indicating the selected weft yarn;

a weft drive means, one for each weft yarn, for driving the weft yarns to said weft insertion means, each said weft drive means including

a feed roller constantly driven by a shaft rotated in synchronism with a weaving cycle of the loom;

a pressure roller arranged to be brought into and out of pressure engagement with said feed roller,

said feed roller and said pressure roller having the weft yarn therebetween;

another roller adapted to be driven by said feed roller in accordance with separation of said pressure roller from said feed roller, said another roller being disposed in opposition to the inner periphery of the feed roller for rolling engagement therewith;

means for drive transmitting connection between said pressure roller and said another roller, and

selective control means operatively connected with said pressure roller and with said another roller for controlling movement of said rollers in dependence on said signal for pressure engagement of said pressure roller with said feed roller while separating the pressure roller form said feed roller in the absence of said signal.

3. A shuttleless weaving loom as defined in claim **2**, comprising a reciprocally movable carrier arm fixedly carrying two spaced parallel spindles, between which a brim of said feed roller is disposed, one of said spindles rotatably carrying thereon said pressure roller and the other of said spindles rotatably carrying thereon said another roller.

4. A shuttleless weaving loom as defined in claim **3**, wherein said means for drive transmitting connection comprises pinions respectively connected to said pressure roller and said another roller in constant mesh with each other.

5. A shuttleless weaving loom as defined in claim **4**, in which the gear ratio of said pinions is determined that the peripheral velocity of the pressure roller in the

inoperative position is substantially larger than the velocity of the pressure roller in the operative position.

6. A shuttleless weaving loom as defined in claim 3, in which said selective control means comprises a cam rotatably mounted on a cam shaft, a sprocket wheel mounted on the cam shaft concentrically and integrally with said cam, a chain wrapped around the sprocket wheel and having one end connected with said weft selector means for rotation of the cam in accordance with said signal, a cam lever having one end carrying a cam follower and being rockable about a fixed shaft in dependence on engagement and disengagement of the cam follower with surface of said cam, an oscillatory lever linked with rocking movement of said cam lever, and connecting means for operative connection of the oscillatory lever with carrier arm.

7. A shuttleless weaving loom as defined in claim 6, in which said connecting means comprises a lost motion connection including means biasing the oscillatory lever and the carrier arm toward each other.

8. A shuttleless weaving loom as defined in claim 2, in which said weft selector means comprises a dobby mechanism including thereon a pattern card arrangement carrying thereon said weft pattern signals, and a plurality of shedding levers operable in accordance with said weft pattern signals each forming a shed by a group of warps corresponding to the selected weft to be inserted, and in which said selective control means is operatively connected with a part of the shedding levers for controlling the weft drive means.

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